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(56) Documents Cited
GB 2011243 A GB 1564239 A GB 1138836 A
FR 002371897 A1 US 5003708 A US 4674204 A
US 4187621 A

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(54) Abstract Title
Foam insole having areas of different density

(57) An insole 100 comprises a compression moulded polymer foam layer 150 having at least one area of high density foam 102 and at least one area of low density foam 112, 122, 132. The high density foam has an average density of ca. 25% greater than that of the low density foam. Typically, the polymer foam layer comprises polyurethane foam. The low density foam area may be provided in a forefoot region, a heel region, or an arch region of the insole or may be in all of these regions. The polymer foam layer may comprise a top surface and a bottom surface, wherein an additional foam layer 160 may be adhesively secured to the bottom surface and a fabric layer (170, Fig. 2) may cover the top surface. A slipper (300, Fig. 5) comprising the insole as well as a methods for manufacture are also disclosed.

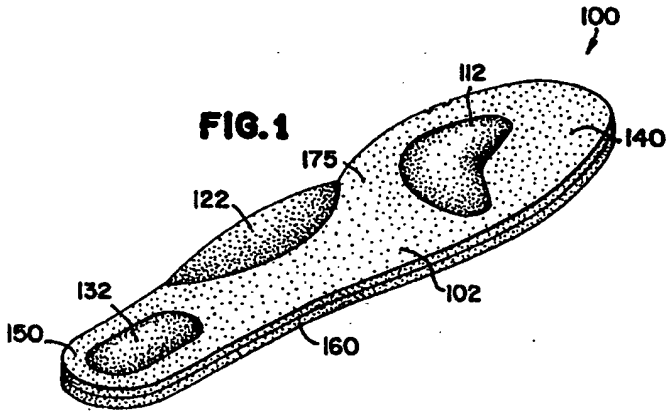

FIG. 1

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FIG. 1

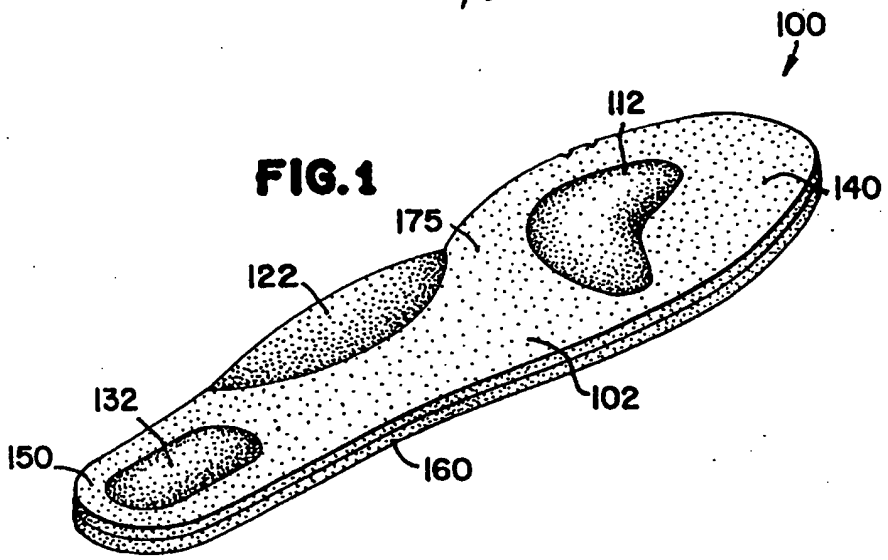

FIG. 2

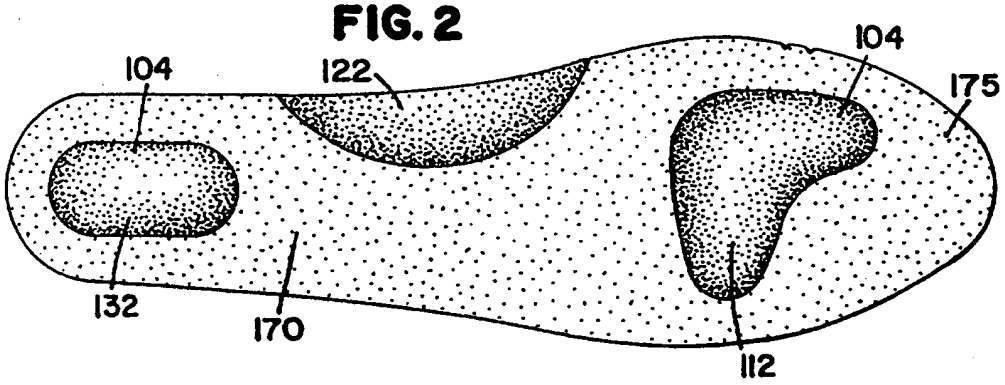

FIG. 3

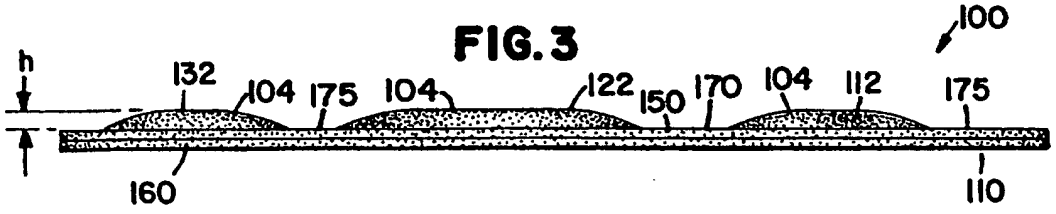

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FIG.4

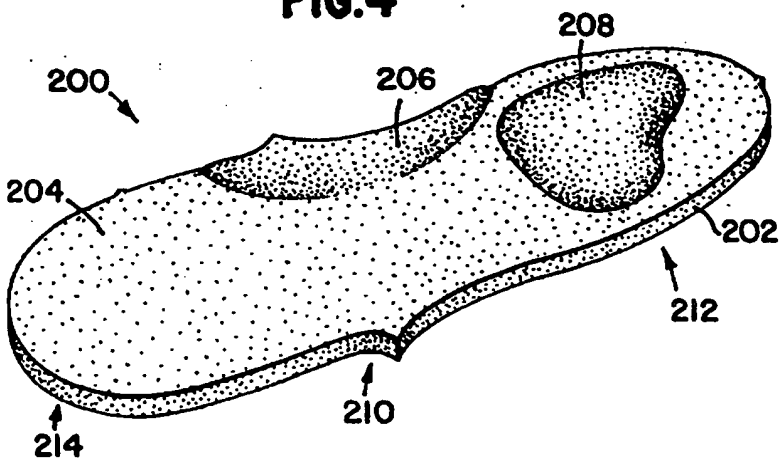
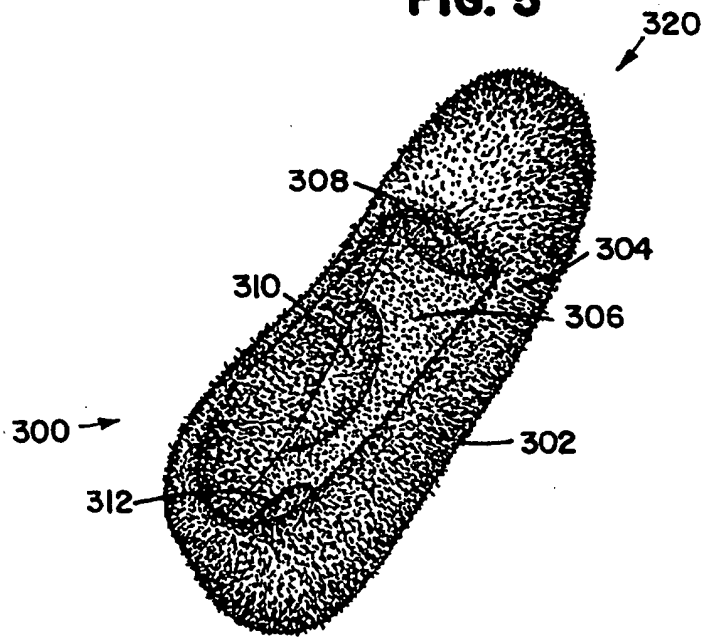


FIG. 5



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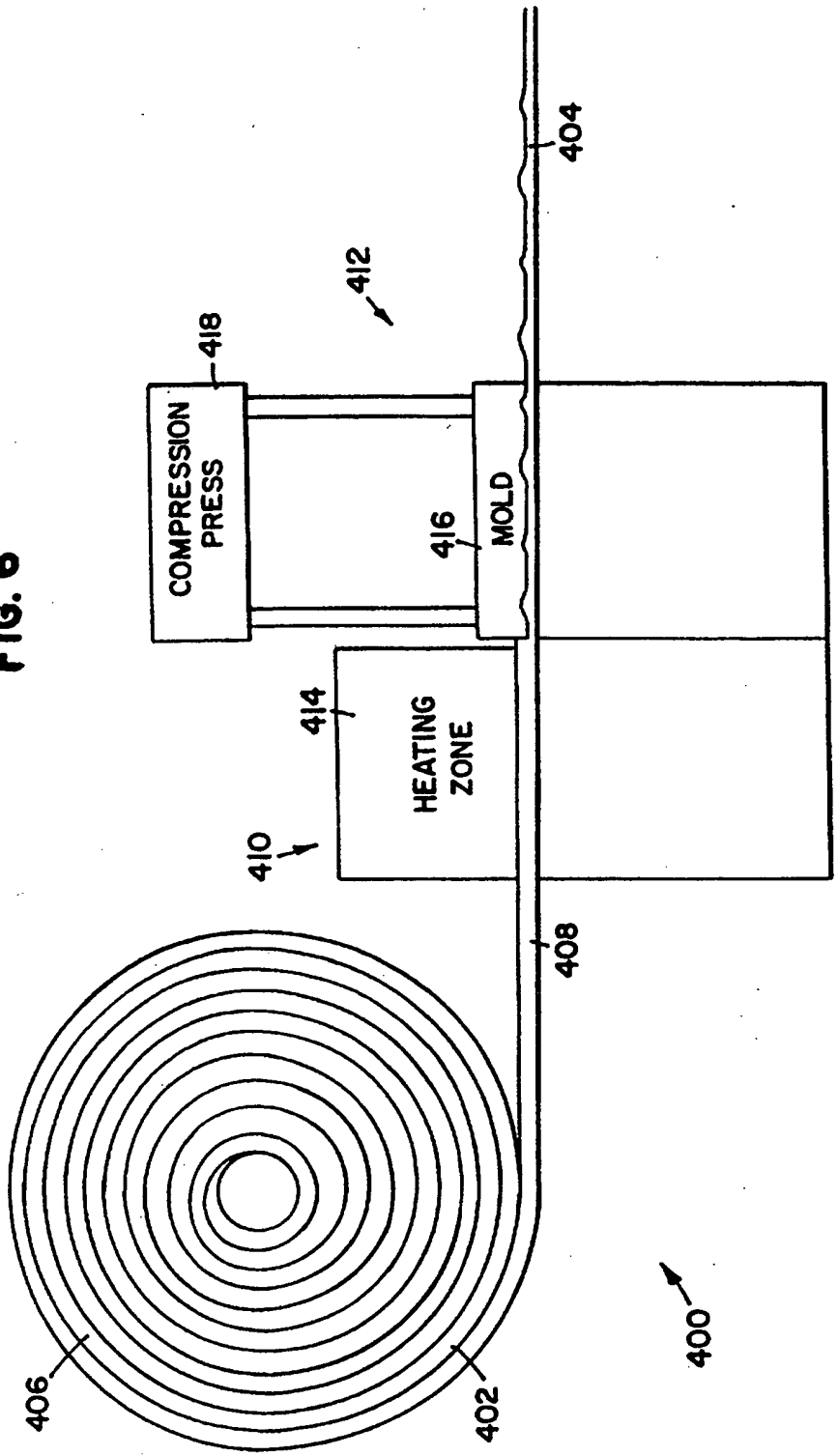
404
412
418
COMPRESSION PRESS
416
MOLD
414
HEATING ZONE
410
408
406
402
400

FIG. 6

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FOAM INSOLES, SLIPPERS AND METHODS FOR MANUFACTURING

Field of the Invention

The invention relates to foam insoles, slippers including foam insoles, and methods for manufacturing foam insoles and slippers. In particular, the invention relates to a compression molded foam insole having areas of differing density.

Background of the Invention

Slippers often include a soft, foam insole to cushion and support the foot. Foot comfort depends, in large part, on the ability of this foam insole to absorb and redistribute the various forces imposed on the foot during walking and standing. These forces are greatest in the heel, arch and forefoot regions.

Certain shoes or slippers are designed to provide enhanced support to the wearer's foot. Tomlin, U.S. Patent No. 4,124,946, describes a flexible, contoured insole for adding foot support. Fukuoka, U.S. Patent No. 3,468,040, describes a plastic sandal having a sole contoured to fit the wearer's foot. Sullivan, U.S. Patent No. 4,674,204, describes a contoured insole made from polyurethane. Fisher et al., U.S. Patent No. 5,611,153, describe a molded, contoured insole for relieving foot pain.

Insoles can be designed to provide therapeutic benefits. Mauch, U.S. Patent No. 4,760,655, and Fukuoka, U.S. Patent No. 4,033,054, describe latex rubber foams having contoured surfaces providing pressure stimulation points that correspond to known reflexology zones. The use of small magnets within the contoured surfaces is also described. Buchsenschuss, U.S. Patent No. 5,664,342, describes a cork-latex rubber insole having a number of small knobs forming massaging nodules.

Wang, U.S. Patent No. 5,167,999, describes a cushioning insole, along with other cushioning systems, that includes numerous unconnected bubbles that are filled with water.

Summary of the Invention

An insole for use in footwear is provided according to the invention. The footwear is preferably a slipper. The insole is a compression molded polymer foam layer and is constructed for being received within an insole receiving area of footwear. The compression molded polymer foam includes a forefoot region, an arch region, and a heel region. At least one of the forefoot region, arch region, and heel region includes a low density foam area and a high density foam area. The high

density foam area has an average foam density that is about 25% greater than the average foam density of the low density foam area.

A method for manufacturing a foam insole is provided according to the invention. The method includes compression molding a thermoformable foam to provide an insole. The insole includes a compression molded polymer foam layer having at least one low density foam area and at least one high density foam area. The step of compression molding includes heating the thermoformable foam layer to a temperature above the glass transition temperature of the thermoformable foam, and compressing the foam in a mold.

A slipper is provided according to the invention. The slipper includes an insole, an outsole and an upper. The insole is positioned between the outsole and the upper. The insole includes the compression molded polymer foam layer. In addition, the insole can include an additional foam layer provided adjacent the compression molded polymer foam layer.

A method for manufacturing a slipper is provided according to the invention. The method includes a step of providing an insole, an outsole, and an upper, and providing the insole adjacent the outsole, and attaching the upper to the outsole to provide a foot receiving area between the upper and the insole. The insole includes the compression molded polymer foam layer.

Brief Description of the Figures

Figure 1 is a perspective view of a foam insole according to the invention;

Figure 2 is a top plan view of the foam insole shown in Figure 1;

Figure 3 is a side elevation view of the foam insole shown in Figure 1;

Figure 4 is a perspective view of an alternative embodiment of a foam insole according to the invention;

Figure 5 is a perspective view of a slipper according to the invention; and

Figure 6 is a diagrammatic view of a method for manufacturing a foam insole according to the invention.

Detailed Description

Slippers are intended to provide soft, cushioning comfort to the feet of the person wearing the slippers. Slippers generally have an outsole, an upper and an insole. The insole fits in an insole receiving area provided between the outsole and the wearer's foot. Sometimes, a sock is placed covering the insole. Slippers

generally include regions having names corresponding to the similar portions of a wearer's foot. For example, a slipper can include a forefoot region, an arch region, and a heel region. The forefoot region generally includes the portion of the slipper which receives the wearer's toes and the ball of the foot. The arch region generally refers to the central portion of the slipper which receives the arch, and the heel region generally refers to the rear portion of the slipper that receives the heel.

Compression molded foam insoles are provided according to the invention having areas of increased cushioning relative to other portions of the insole. The areas of increased cushioning are generally found in the portions of the insole which receive the greatest amount of pressure. For example, the areas of increased cushioning are particularly found in at least one of the forefoot region, the arch region, and the heel region.

The foam insole of the invention includes a foam layer having regions of differing foam densities. The foam layer is preferably made from one or more sheets of thermoformable foam. In a preferred embodiment, the thermoformable foam is polyurethane foam. Layers of thermoformable foam can be compressed to provide insoles via compression molding, which involves the application of heat and pressure. The insoles can include areas having additional or increased cushioning in parts of the insole. The areas of additional or increased cushioning provide a lower foam density than the remaining regions of the insole.

Now referring to Figures 1-3, a foam insole according to the invention is shown at reference numeral 100. Foam insole 100 has a high density area 102 and several low density areas 112, 122, and 132 that each have an average density that is less than that of high density area 102. Although the foam insole 100 is shown having three low density areas, it should be appreciated that the foam insole can be provided having one or more low density areas. That is, not all of the low density areas 112, 122, and 132 need to be present in the foam insole according to the invention. In a preferred embodiment, the average density of high density area 102 is about 25 percent higher than the density of the low density areas 112, 122, and 132. Preferably, low density areas 112, 122, and 132 are at least partially surrounded by high density area 102. The high density area 102 is preferably a continuous area interrupted by one or more low density areas. It should be appreciated that the low density areas can be identified by a change in height from the high density area. In general, the measurement of the density of the low density areas can be taken across the depth of the thermoformable foam provided the location where there is a change in height from the high density area.

Low density areas 112, 122, and 132 are of lesser density than high density area 102 because they are not compressed as much. It should be appreciated

that the formation of the low density and high density areas are the result of different degrees of compression during compression molding. For example, the high density area is compressed to a greater extent than the low density areas. Furthermore, although the phrases "high density" and "low density" are used in this application, it should be understood that these names refer to particular areas of the insole. There is no assertion that the "low density area" has a low density. Rather, the name "low density area" is used to identify a particular area of the insole having a density which is lower than the "high density area." Furthermore, the name "high density area" is not an indication that the area referred to has a high density, but rather a higher density than the low density area.

As shown in Figures 1-3, the low density area 112 is provided in the forefoot region 110 for cushioning the balls of a wearer's foot, the low density area 122 is provided in the arch region 120 and the low density area 132 is provided in the heel region 130.

The low density areas extend above the high density area by height h as shown in Figure 3. That is, the height h can be measured from the top surface 175 of the high density area 102 to the top surface 104 of the low density areas. In addition, it should be appreciated that the height of each low density area can be different.

Foam insole 100 can be made from several layers of foam. As shown in Figure 3, foam insole 100 includes two layers of foam; an upper layer 150 and a lower layer 160. The foam layers 150 and 160 can be the same weight and density, or they can be of differing weight and density. The foam layers 150 and 160 can be adhered together using an adhesive before, during, or after compression molding. In addition, the upper layer 150 can be a thermoformable foam, and the lower layer 160 may or may not be a thermoformable foam. That is, although upper layer 150 undergoes a compression molding operation, there is no requirement that the lower layer 160 is compression molded.

The foam insole 100 can additionally include a fabric layer 170 which can be provided covering the top layer 150. The fabric layer 170 is advantageous to reduce sticking of the top layer 150 to the mold which is used for compression molding.

In another embodiment, as shown in Figure 4, foam insole 200 can be made from a single layer of polyurethane foam. The perimeter 202 of the foam insole 200 is provided with a configuration which is applicable for a particular slipper design. It should be appreciated that the configuration of the insole perimeter according to the invention is generally determined based upon the particular slipper design in which the insole is to be used. The foam insole 200 includes a high

density area 204 and two low density areas 206 and 208. The low density area 206 is provided in the arch region 210, and the low density area 208 is provided in the forefoot region 212. The foam insole 200 does not include a low density area in the heel region 214.

Now referring to Figure 5, a slipper 300 is shown according to the invention. The slipper 300 includes an outsole 302, an upper 304, a sock 306, and an insole provided between the sock 306 and the outsole 302. Although the insole is not visible in the slipper 300, the low density areas 308, 310, and 312 can be seen. The slipper design shown in Figure 5 can be referred to as a closed-toe vamp design 320. It should be appreciated that additional slipper designs, such as open-toe vamp designs, clog designs, etc. can be practiced incorporating the foam insole according to the invention.

The thermoformable foam layer can be manufactured into a foam insole according to the invention by undergoing a compression molding step in which heat and pressure are used to reshape the foam. In a preferred embodiment of the invention, the compression molded insole of the invention is made from a thermoformable foam that is readily available in sheet form. Suitable foams are available commercially from Carpenter, Foam Design and Bayer under the designation "thermoformable foam." Thermoformable foams which can be used according to the invention are described, for example, in U.S. Patent Nos. 4,129,697; 4,508,774; and 4,741,951, which are incorporated by reference herein.

Now referring to Figure 6, a method for manufacturing a foam insole according to the invention is shown diagrammatically at reference numeral 400. As shown, foam feed stock 402 is processed into molded foam 404. The foam feed stock 402 is preferably provided in the form of a roll 406 which unwinds providing a source of thermoformable foam layer 408 for processing. The thermoformable foam layer 408 is first heated in a heating zone 410 and then compression molded in a thermoforming zone 412. The heating zone 410 preferably includes an oven 414, and the thermoforming zone 412 preferably includes a mold 416 and a compression press 418. The resulting molded foam 404 can be cut to provide insoles having desired shapes. The thermoformable foam layer 408 can be provided as a single foam layer or as an assembly of discrete foam layers. The only requirement is that the top foam layer is thermoformable to provide areas of low density in the compressed foam layer. Alternatively, the molded foam 404 can be provided as a single foam layer and then laminated or adhered to another foam layer.

Foams which are particularly useful for compression molding include those foams which are not completely reacted. For example, polyurethane foams can be provided so that when they are compression molded, they cure to provide a

final molded foam product. That is, when heated and exposed to pressure, they are able to react completely and thereby retain a desired shape.

The foam insoles of the invention are preferably prepared from polyurethane foam having a thickness which is sufficient to provide desired cushioning, but is not too thick so that it is difficult to compress or, once compressed, becomes too dense to function well as a cushioning material. In general, the foam insoles, according to the invention, are prepared from a polyurethane foam that is about 0.5 inch thick to about 1.5 inches thick. A preferred foam is about 0.75 inch thick to about 1.25 inches thick, and more preferably about one inch thick.

Prior to compression molding, the foam preferably has a density which is sufficient to provide a thermoformed foam having sufficient structure, but not too much density to provide a thermoformed foam which is too hard and which may lose its cushioning ability. In general, the foam, prior to compression molding, preferably has a density of from about 1.5 lb./ft.^{3} to about 10 lb./ft.^{3}, as measured at ambient temperature and pressure.

To make a compression molded foam insole, a sheet of polyurethane foam can be heated to a temperature at which it is capable of being permanently shaped. This temperature corresponds to the reaction temperature of the polymer used to make the foam. The heated foam is placed into a mold. This mold is contoured to produce an insole having a desired shape and density areas. The foam may be heated within the mold, or it can be heated by passing it through a heated tunnel or oven prior to placing the foam within the mold. Molding temperatures vary according to the chemical formulation of the polyurethane, but are preferably between about 125°C and 200°C.

To compression mold the heated foam, the two halves of the mold are brought together. The bottom of the resulting compression molded foam insole is preferably flat, but can be provided with contours, if desired. Preferably, the molding process results in a compression molded foam insole having one surface that is compression molded to provide a desired contour and a second surface which remains relatively flat. The entire molding operation varies according to the chemical characteristics of the foam, the thickness involved, and the complexity and detail of the raised sections, but preferably lasts about 90 seconds.

The embodiments of the insole shown in Figures 1 and 4 include three and two low density areas, respectively. If desirable, the insole according to the invention can be provided with one low density area, two low density areas, three low density areas, or more. In addition, each of the forefoot region, arch region, and heel region can be provided with only one low density area. That is, the

insole of the invention can exclude multiple discreet low density areas within each of the forefoot region, arch region, and heel region. In addition, the insole of the invention can have multiple low density areas in any one or more of the forefoot region, arch region, and heel region.

The following example is intended to illustrate the invention but is not to be construed as limiting the invention.

Example

A compression molded foam insole of the invention was made from a sheet of polyurethane foam about 1 inch thick. This material was cut to a size of about 15 inches by about 20 inches and was heated to a temperature of about 175°C. The polyurethane foam used is available commercially from Foam Design.

After reaching the appropriate temperature, the heated foam was placed between mold halves and the mold halves were brought together, thereby compressing the foam to conform to the shape of the mold cavity. This resulted in a foam piece that had the shape of the insole portion of the slipper with specific sections in which the thickness was greater than that of the main, relatively flat base of the insole. The molding cycle for the slipper insole was about 90 seconds; from the time heat was initially applied to the foam to the time the mold was released.

The above specification, examples and data provide a complete description of the manufacture and use of the composition of the invention. Since many embodiments of the invention can be made without departing from the spirit and scope of the invention, the invention resides in the claims hereinafter appended.

WE CLAIM:

1. An insole comprising a compression molded polymer foam layer constructed for being received within an insole receiving area of footwear, said compression molded polymer foam having a forefoot region, an arch region, and a heel region, and including at least one area of high density foam and at least one low density foam area, the high density foam area having an average foam density that is about 25 percent greater than the average density of the low density foam area.

2. An insole according to claim 1, wherein the low density foam area is provided in the forefoot region.

3. An insole according to claim 1, wherein the low density foam area is provided in the heel region.

4. An insole according to claim 1, wherein the low density foam area is provided in the arch region.

5. An insole according to claim 1, wherein each of the forefoot region, the arch region, and the heel region include a low density foam area.

6. An insole according to claim 1, wherein each of the forefoot region and the arch region include a low density foam area, and the heel region does not include a low density foam area.

7. An insole according to claim 1, wherein the forefoot region includes only one low density foam area, the arch region includes only one low density foam area, and the heel region includes only one low density foam area.

8. An insole according to claim 1, wherein the compression molded polymer foam layer comprises polyurethane foam.

9. An insole according to claim 1, wherein the compression molded polymer foam layer comprises a top surface and a bottom surface, and said insole comprises a foam layer adhered to the bottom surface of the compression molded polymer foam layer.

10. An insole according to claim 7, further comprising a layer of fabric over the top surface.

11. A slipper comprising:

(a) an insole, an outsole and an upper, the insole positioned between the outsole and the upper;

(b) the insole comprising a compression molded polymer foam layer constructed for being received within an insole receiving area of footwear, said compression molded polymer foam having a forefoot region, an arch region, and a heel region, and including at least one area of high density foam and at least one low density foam area, the high density foam area having an average foam density that is about 25 percent greater than the average density of the low density foam area.

12. A slipper according to claim 11, further comprising a sock provided covering the insole.

13. A method for manufacturing a foam insole, said method comprising steps of:

(a) compression molding a thermoformable foam to provide an insole comprising a compression molded polymer foam layer constructed for being received within an insole receiving area of footwear, said compression molded polymer foam having a forefoot region, an arch region, and a heel region, and including at least one area of high density foam and at least one low density foam area, the high density foam area having an average foam density that is about 25 percent greater than the average density of the low density foam area.

14. A method according to claim 13, wherein said step of compression molding comprises heating a thermoformable foam layer to a temperature above the glass transition temperature of the thermoformable foam, and compressing the foam in a mold for compression molding.

15. A method for manufacturing a slipper, the method comprising steps of:

(a) providing an insole, an outsole, and an upper, the insole comprising a compression molded polymer foam layer constructed for being received within an insole receiving area of footwear, said compression molded polymer foam having a forefoot region, an arch region, and a heel region, and including at least one area of high density foam and at least one low density foam area, the high density foam area having an average foam density that is about 25 percent greater than the average density of the low density foam area; and

(b) providing the insole adjacent the outsole, and attaching the upper to the outsole to provide a foot receiving area between the upper and the insole.

Application No: GB 0100384.7 **Examiner:** Dr Paul R Minton
Claims searched: 1-15 **Date of search:** 7 March 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): A3B.

Int Cl (Ed.7): A43B 7/28, 13/38, 13/40, 17/00, 17/14.

Other: ONLINE: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	GB 2011243 A	(FREUDENBERG). See whole document.	X:1-5,13 at least Y:11,15
X,Y	GB 1564239 A	(FREUDENBERG). See particularly lines 53-69, page 1 & lines 10-12, page 2.	X:1,13 at least Y:11,15
Y	GB 1138836 A	(GENERAL FOAM). See particularly lines 20-29, page 1.	11,15
X,Y	US 5003708 A	(DALEY). See particularly lines 47-58, column 3 and Figure 3.	X:1,13 at least Y:11,15
X,Y	US 4674204 A	(SULLIVAN *et al*). See particularly lines 58-61, column 4, lines 58-62, column 5 & lines 25-26, column 9 and Figure 7.	X:1,8,13 at least Y:11,15
X,Y	US 4187621 A	(COHEN). See particularly lines 28-38, column 1 & lines 49-51, column 2.	X:1,13 at least Y:11,15

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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Application No: GB 0100384.7 **Examiner:** Dr Paul R Minton
Claims searched: 1-15 **Date of search:** 7 March 2001

Category	Identity of document and relevant passage		Relevant to claims
X,Y	FR 2371897 A1	(ADIDAS). See particularly WPI Abstract Accession No. 1978-62214A [35], lines 1-6, page 5 and Figures 2-3.	X:1,2,13 at least Y:11,15

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.